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Hill Grassland for Beef Production

H. L. Borst Paul Gerlaugh Myron Bachtell

OHIO AGRICULTURAL EXPERIMENT STATION

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HILL GRASSLAND *for* BEEF PRODUCTION[1]

H. L. BORST,[2] M. A. BACHTELL,[3] AND PAUL GERLAUGH[4]

Ohio's southeastern hills present serious soil erosion problems. During the decade previous to 1943, the Soil and Water Conservation Station at Zanesville conducted research showing the value of grass cover in reducing rainfall runoff and thus controlling loss of soil by erosion. Findings indicated that wise land use meant keeping much of the hill land either permanently or semi-permanently in grass of high feeding value. Fortunately, during this period, methods had been developed which permitted a rather easy start on such a program. It had been shown that the trash-mulch method of seeding made it possible to change the vegetation on so-called worn out hillsides from that without feeding value (poverty grass and broom sedge) to nutritious legumes and grasses in the short period of a year or less. Many farmers copied the method and proved its adaptability under a variety of conditions.

It was easy to see that if extensive acreages of hill land were seeded to grasses and legumes, a problem of forage utilization would arise. Work at various places had given considerable information concerning dairy and sheep husbandry under intensive grassland culture. At the Soil and Water Conservation Station it was decided to concentrate on beef production. Conditions as they existed in hill country and by contrast quite different from those on less hilly land where meadows are grown in definite rotations would be used. Accordingly, a 5-year test of beef production was conducted during the period from 1943 through 1947.

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[1]Joint research project of the Ohio Agricultural Experiment Station and the Soil Conservation Service.

[2]Project Supervisor, U. S. D. A., S. C. S. research, Ohio Agricultural Experiment Station, formerly at the Zanesville Station.

[3]Associate Professor, Ohio Agricultural Experiment Station.

[4]Professor, Animal Science, Ohio Agricultural Experiment Station (deceased).

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This test was not designed to make any critical comparison with any other type of livestock husbandry. Its purpose was to get information on what beef production might be obtained with a maximum of hill grown forage and a minimum of grain. Production was measured in gains per steer and in pounds of beef produced per acre of pasture.

THE FARM PLAN

This 250-acre hill farm had slopes of up to 20 percent and less than 3 acres of bottom land. About 24 acres on some of the gentler slopes had been terraced and strip cropped. A 4-year rotation of corn, wheat, meadow, meadow was followed on this area. Part of the hay used for winter feeding, some straw for bedding and the corn that was fed for finishing the cattle on grass came from here. Numerous other areas were trash-mulched and seeded to legume-grass mixtures. These areas were used for hay or pasture as conditions seemed to make desirable.

Bluegrass pastures were improved by liming and fertilizing but no reseeding was done. Consequently, there was none of the advantage which modern bluegrass pastures gain from the introduction of ladino clover or birdsfoot trefoil.

Feeders were purchased in late summer or early fall and carried on bluegrass until they were put on winter feed. They were sold off of pasture the following fall. During the 5-year period their stay on the farm averaged 347 days.

THE WINTER PERIOD

For the 5-year test, the steers spent an average of 154 days in the barn during the winter periods or 44 percent of the time. During this time they gained an average of 68 pounds per steer which was 18 per-

TABLE 1.—Number of Days in Various Feeding Periods

Period	1943	1944	1945	1946	1947	5-year average
Fall, bluegrass permanent pasture	50	36	62	55	0	40.6
Winter, barn feeding	157	174	144	153	141	153.8
Spring, bluegrass	70	38	30	49	32	43.8
Summer, legume-grass	10	14	47	19	62	30.4
Summer, legume-grass+corn	57	74	60	79	67	67.4
Fall, bluegrass + corn	28	11	6	0	10	11.0
Totals	372	347	349	355	312	347.0

cent of the year's total gain. During 3 of the 5 years the average daily gain was slightly more than one-half pound per day for this period; one year it was slightly less and one year the spring weight was only a little more than that of the previous fall.

Winter feed was entirely of hay made on the farm. No grass silage was fed. Some of the hay contained orchard grass in a too-mature stage for the highest quality. To offset, at least partially, this lack of quality in the hay the steers were fed an excess which permitted them to pick out the better parts. The refuse then was used for bedding. Resulting gains, which averaged approximately one-half pound per day per steer, are considered satisfactory for this type of beef production. The aim here is to bring the feeders through the winter in shape to make satisfactory gains during the following season on pasture. A further indication of satisfactory winter performance was found in the daily gains steers made when they went out to pasture. Satisfactory gains during the winter and the first month of spring pasture indicate that winter feed problems can be met without any great difficulty by hill farmers who plan to produce beef under grassland conditions.

THE PASTURE PERIOD

Two types of pastures were used, (1) permanent bluegrass and white clover that had been treated with lime and fertilizer and (2) meadow-type pastures which were mixtures of alfalfa and ladino clover with timothy, orchard grass or bromegrass. These were sown by the trash-mulch method on fields which had been idle since the establishment of the station and which had grown up to weeds, poverty grass and broom sedge. Since orchard grass was used in some of the early seedings and bromegrass was slow in becoming established, the orchard grass spread and became the predominant grass in most of the meadow pastures. Alfalfa was the legume that was given preference because of its deeper root system which provided it with more drouth resistance on the hills in dry weather. Ladino clover was added to certain fields before the test was completed.

(a) **Permanent bluegrass.** The use of bluegrass came at two rather distinct periods. The first period was for an average of 41 days in the fall after the feeders were purchased. During this period the recently moved feeders gained an average of nearly three-fourths of a pound per day.

A limited use of bluegrass in the fall was made by the feeders that were about ready for sale. These fall periods were relatively short and averaged only 11 days per season for the 5-year period. Daily gains

Fig. 1.—Here are some of the test herd on an alfalfa grass area in early September.

averaged only 1.27 pounds per steer even though supplemental corn was fed along with the pasture at the daily rate of 9 pounds per steer. During these 11 days each steer ate 1.4 bushels of corn.

The most important bluegrass period came in the spring and lasted for 44 days during which daily gains averaged 1.78 pounds per steer. In three of the five years the steers went directly from winter quarters to the bluegrass; the other two years they had brief access to meadow-type pasture before going on to bluegrass.

During these three periods on bluegrass, the gains averaged 115 pounds per steer for the 96 days involved. This represented 37 percent of the feeding year and 30 percent of the total annual gain. The average daily gain for these periods was approximately 1.25 pounds. Considering that the bluegrass area was on the poorest land on the farm this is a rather creditable showing for bluegrass.

(b) **Grass-legume meadows.** For an average of 98 days including the hotter, drier part of the summer, dependence was placed on meadow type pastures. During the first 30 days, the steers received no

TABLE 2.—Average Gain in Pounds per Animal in Various Feeding Periods

Period	1943	1944	1945	1946	1947	5-year average
	(855)*	(613)*	(647)*	(641)*	(681)*	
Fall, bluegrass permanent pasture	15	28	43	61	0	29.4
Winter, barn feeding	88	96	13	70	73	68.0
Spring, bluegrass	92	66	67	77	65	73.4
Summer, legume-grass	15	28	99	27	141	62.0
Summer, legume-grass+corn	135	152	139	177	84	137.4
Late summer, bluegrass+corn	29	11	11	0	12	12.6
Total gains	374	381	372	412	375	382.8

*Original weights.

grain; during the remaining 68 days (average) the pasture was supplemented with a daily average of 5.5 pounds of ground corn and cob meal per steer. Average daily gains per steer were 1.86 pounds for the first period (pasture only) and 2.05 pounds for the second period when corn was fed along with the pasture. Average amount of ground ear corn consumed per steer during this period was 5.4 bushels per steer. Animal Science specialists point out that in dry lot feeding this amount of corn could make approximately 54 pounds of beef. In the Zanesville test there was no way of accurately determining how much of the gain during this latter period on grass-legume meadows was due to corn and how much was due to the pasture.

While animals were on grass-legume meadow type pasture, total gain per steer averaged 199 pounds. Although this was only 28 percent of the time the steers were on the farm, the gains made were 52 percent of the total for the entire period. Therefore, this relatively short interval must be considered as highly important when beef production is based on maximum pasture consumption. Quantity as well as quality of pasture during this period has a bearing not only on the gains per steer but also on the returns per acre of meadow type pasture.

ACRE PERFORMANCE

Average gain per day is one indication of the efficiency of pasture but the yearly gain per acre of pasture holds the key to its economic valuation. During the 5 years at the Soil and Water Conservation Station, total production from the spring and fall growth of permanent bluegrass pasture averaged 134 pounds of beef per acre; from the summer use of legume-grass meadow-type pastures it was 191 pounds of

TABLE 3.—Average Daily Gains During the Feeding Periods

Period	1943	1944	1945	1946	1947	5-year average
Fall, on bluegrass	.30	.78	.69	1.11	0	.72*
Winter barn feeding	.56	.55	.09	.46	.52	.44
Spring, on bluegrass	1.31	1.74	2.23	1.57	2.03	1.78
Summer on legume-grass	1.50	2.00	2.11	1.42	2.27	1.86
Summer on legume-grass + corn	2.37	2.05	2.32	2.24	1.25	2.05
Late summer on bluegrass + corn	1.04	1.00	1.83	0	1.20	1.27*
Entire feeding period	1.00	1.10	1.07	1.16	1.20	....

*4 years only.

beef per acre. (Possible gains from the corn fed, previously noted, would be deducted). During the 5-year period it required approximately 2 acres per steer to supply hay and pasture for feeders which weighed an average of 627 pounds when started and 1,009 pounds when sold.

This is a fairly creditable yield of beef from a farm that before improving was practically abandoned hill land. It is still below the amount that is being obtained from productive meadows on more fertile land in western Ohio and other corn belt areas. At the Madison County Experiment Farm gains of over 300 pounds of beef per acre have been obtained from the first year or two of rotated meadows. Work in Indiana on level land has shown the possibility of exceeding 300 pounds of beef per acre from well fertilized trefoil-bluegrass, ladino-bromegrass or alfalfa-timothy pastures.

THE SOIL FERTILITY PROBLEM

Continued heavy production of legume-grass mixtures draws heavily on soil minerals, especially potash. Pasturing of hillsides does not reduce this drain as much as many people think. This is because animals soon fill up on luxuriant pastures and then are likely to spend comparatively long periods in favored spots where they have access to shade and water. This tends to prevent the manure from being scattered evenly over the area where the grazing occurs. As a matter of fact the manure from pasturing is not spread as evenly as from winter feeding where crops are hauled to the barn from rotated fields and manure hauled back with the manure spreader.

Continued large yields of beef from hill grassland culture require liberal fertilization if satisfactory results are to be obtained. The test at Zanesville overlapped the war period and its aftermath when it was

TABLE 4.—Approximate Beef Production per Acre of Pasture

Year	Per acre of permanent bluegrass	Per acre of meadow-pasture*
	Lb.	Lb.
1943	135	175
1944	125	175
1945	135	210
1946	135	205
1947	140	190
Av.	134†	191†

*Does not include any areas from which hay was made.
†Include gain from supplemental corn feeding.

very difficult to buy potash. Consequently, the fertilization of established pastures was not always as heavy as it should have been. This probably curtailed the acre yield of beef. It undoubtedly is true that liberal fertilization must be practiced if hill grassland farmers expect to approach the yields of beef that are being obtained on more nearly level and more fertile land.

THE LEGUME-GRASS MIXTURE PROBLEM

During most of the 5-year period at Zanesville new areas of legume-grass meadows were being established by the trash-mulch method. Alfalfa was the favored legume because of deep roots which enabled it to make considerable summer growth on the hillsides even in dry periods. Ladino clover is less adapted to dry hillsides but it was added for increased assurance that some legume would persist with the grass.

Qualities of drouth resistance and summer growth are more developed in brome and orchard grass than in timothy. Of the two, orchard grass possesses these qualities to a greater degree. Seedings during the early part of the 5-year period contained orchard grass; during the latter part brome. Orchard grass caught more easily, came on more quickly and made up a larger part of the mixture. This early development of orchard grass was reflected in the annual dates of blooming and seed maturity. These dates were so early that viable seed was formed in May, perhaps even before the start of hay making but certainly well before the end of that annual event. When hay containing mature orchard grass was fed to steers the resulting manure contained viable orchard grass seed. Seed was carried in the manure when it was spread on meadows and plants became established even where the original seeding was bromegrass or timothy. Consequently, orchard grass rather rapidly came to more or less dominate the various fields.

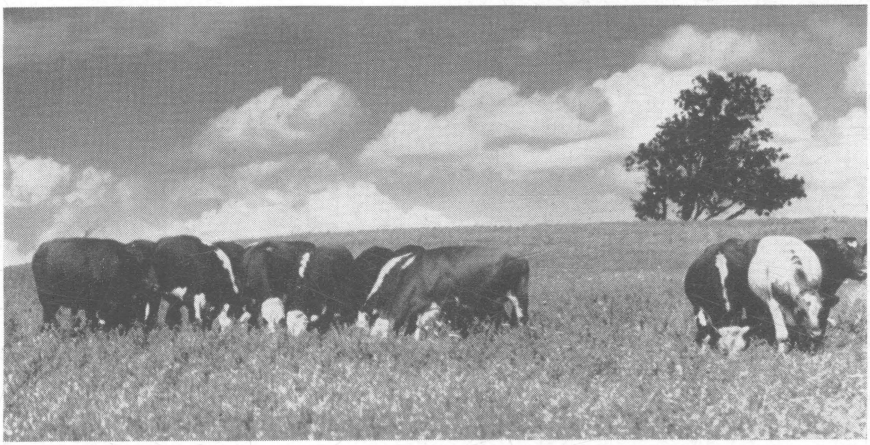

Fig. 2.—The pasture was at this level in August during one year of the tests at Zanesville.

When there is any doubt about manure containing orchard grass seed it should be spread where orchard grass already exists rather than on meadows that are free of orchard grass. Such precautions are unnecessary under conditions where meadows can be plowed for corn and reseeded a year or two later. But in hill culture, where one wishes to take full advantage of the wilt resistant alfalfas for a decade or more of winter hay and summer pasture, strict precaution is well worth while.

Perhaps an insufficient supply of potash was partly the reason but as the orchard grass thickened in stand and exerted its characteristic competitive vigor the alfalfa weakened or disappeared. Meadow pasture from which the legume has disappeared should be rejuvenated to regain a satisfactory legume-grass mixture. Beef cattle can use straight grass pasture, if it is well managed, but the production per acre will be low unless considerable commercial nitrogen is applied. This is considered too expensive to be continued year after year. It is more satisfactory to get the nitrogen through an associated legume.

Orchard grass has some qualities justifying limited use in hill grassland culture but it should be restricted to areas where seed formation can be prevented by pasturing and clipping or by using the first growth to make grass silage. Alfalfa is not a satisfactory companion legume on these areas as the early season cutting required for control of orchard grass is likely to cause a rather rapid disappearance of alfalfa. Ladino clover is benefited by early season cutting of the associated grass.

UNFINISHED RESEARCH

Some work was done on the reseeding of areas that had become predominately grass but the Station was discontinued before any definite plan was proven most satisfactory. Methods will vary depending on the degree of slope and the danger of soil erosion. The problem of renewal, where an aggressive grass has to be completely killed, is likely to be more complicated than the initial seeding which changed the hillside cover from poverty grass to a luxuriant legume-grass combination.

The role of birdsfoot trefoil had not been fully evaluated before the discontinuance of the Station. However, considering the rather creditable results obtained from the native white clover-bluegrass pastures it seems logical to conclude that the introduction of birdsfoot trefoil would make bluegrass areas productive enough to justify this combination on a considerable part of improved hill grassland.

SUMMARY

Beef production from forage produced on rejuvenated hillsides was studied at the Soil and Water Conservation Experiment Station under conditions existing in hilly areas where the danger from soil erosion requires that the land be kept largely or entirely in protective grass covers. This cooperative research was carried on for 5 years by the Ohio Agricultural Experiment Station and Soil Conservation Service at Zanesville, Ohio.

Native feeders which were purchased in the fall and wintered on grass-legume hay, were finished on pasture the following season with supplemental feeding of corn and cob meal which averaged 6.8 bushels per steer.

Pastures consisted of permanent bluegrass for fall and spring and long-lay meadow type grass-legume pastures which were established on the hillsides by trash mulch seeding. The latter furnished some of the hay for winter feed as well as summer grazing.

Steers were fed under cover for 154 days of the winter period. During this time they gained an average of 0.44 pound per steer per day or a total of 68 pounds.

Bluegrass was pastured first in the fall by the newly purchased steers and again in the spring. Gains during the former (fall) period averaged ¾ pound per day for a 40-day period; for the latter (spring) period which lasted 44 days the steers made the very creditable average of slightly over 1¾ pounds per day.

The largest gains were made during the summer on meadow type pastures. For 30 days during the early part of the summer the daily gains averaged nearly 1.9 pounds per steer even though no corn was fed; for another 67 days when supplemental corn feeding averaged approximately 5.4 bushels per steer the average gains were slightly over 2 pounds per day.

Following the summers on grass-legume meadows the steers were returned to the bluegrass pasture for short periods which averaged 11 days. Gains were at the disappointing average of only 1¼ pounds per day even though supplemental corn feeding amounted to 9 pounds per steer daily or a total of 1.4 bushels.

The approximate gain per acre from the bluegrass pasture augmented (11 days only) by corn was 134 pounds; from an acre of hay type pasture plus corn (as noted above) the average gain was 191 pounds of beef.